ASSOCIATION OF DEFENSE COMMUNITIES

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Energy Assurance Through the Smart Grid

How the California Energy Commission is addressing the Future Smart Grid

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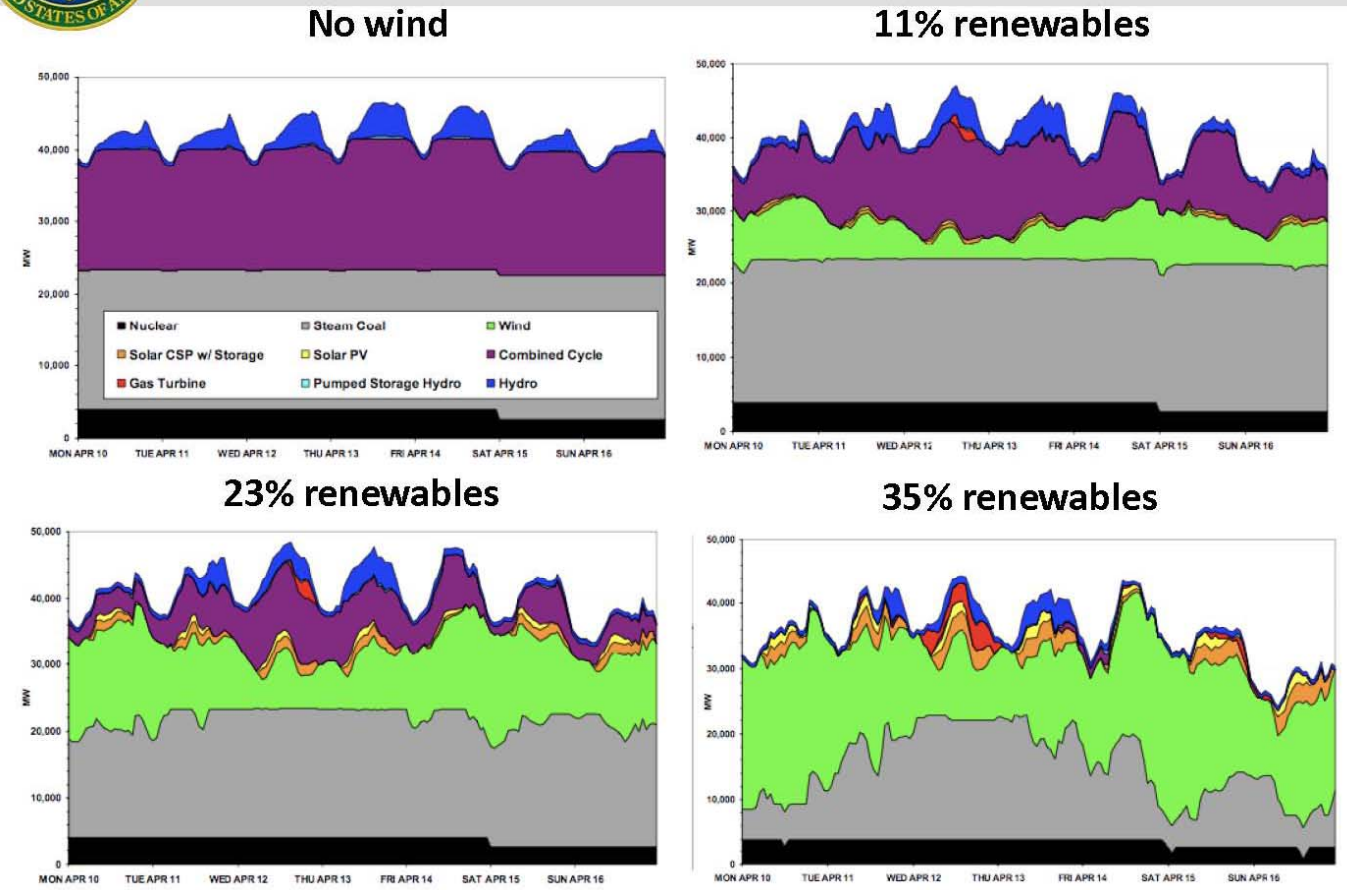
Energy Assurance Through the Smart Grid

Overview:

- **Future Challenges Impacting Energy Assurance**
- California Energy Commission Activities
- Smart Grid Technologies
- Case Study “Smart Grid Initiative at Beale AFB”

Future Grid Challenges

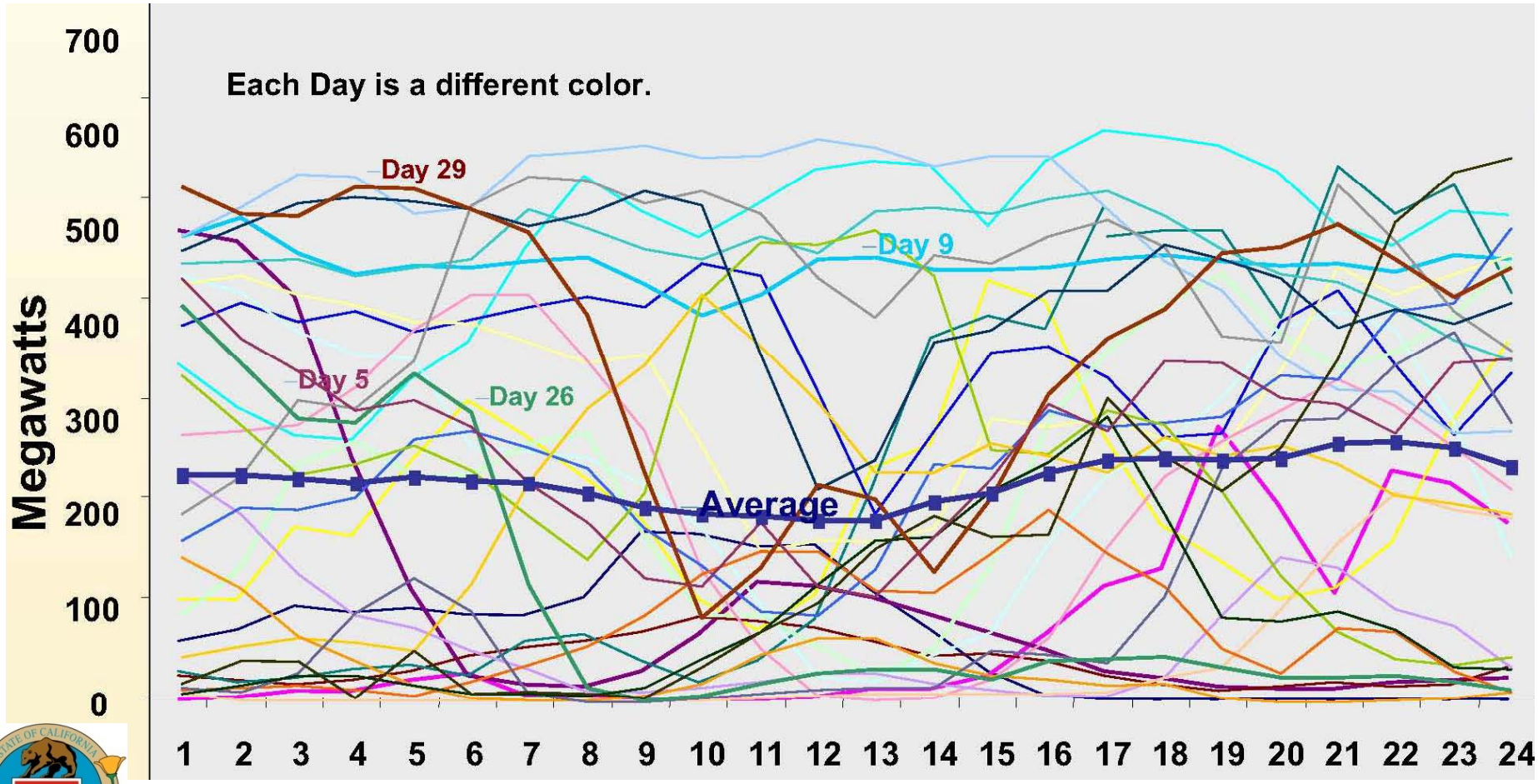
OE - Variable Generation Affects Grid Operations



Lew et. al. "How do Wind and Solar Power Affect Grid Operations: The Western Wind and Solar Integration Study". National Renewable Energy Laboratory. (September 2009). p. 6

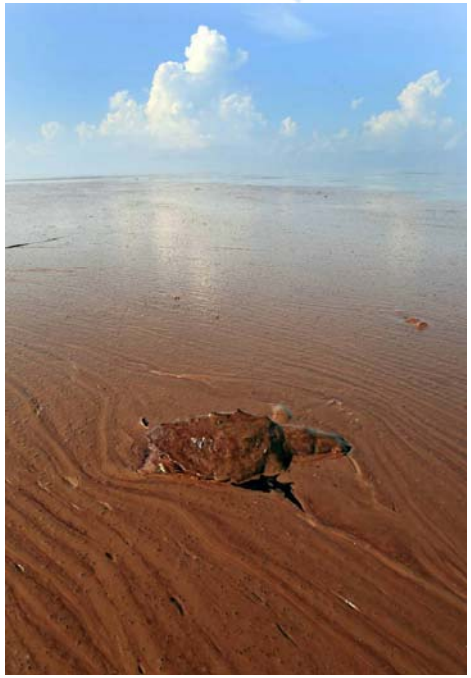
Wind Energy Production is a Challenge to Forecast

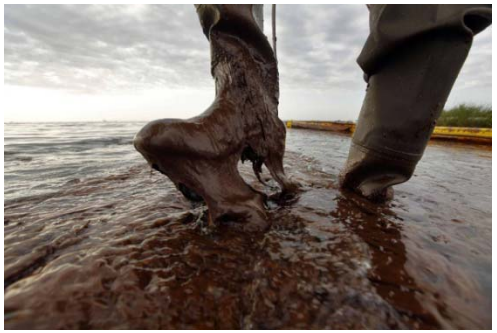
Wind Generation in Tehachapi – April 2005



Source: CAISO, *Integration of Renewable Energy* Presentation, Dave Hawkins and Clyde Loutan, PSERC Presentation, October 2, 2007

Current Events Impact Future Choices





Energy Assurance Through the Smart Grid

August 2, 2010: DOD and DOE Sign MOU on Clean Energy and Energy Security***:***

- "to accelerate clean energy innovation and enhance national energy security"
- MOU Covers efforts in the areas of energy efficiency, renewable energy, water efficiency, fossil fuels, alternative fuels, efficient transportation technologies and fueling infrastructure, grid security, smart grid, storage, waste-to-energy, basic science research, mobile/deployable power, small modular reactor nuclear energy, and related areas

Energy Assurance Through the Smart Grid

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California Energy Commission Responsibilities

- **Forecasting future energy needs and keeping historical energy data.**
- **Licensing thermal power plants 50 megawatts or larger.**
- **Promoting energy efficiency by setting the state's appliance and building efficiency standards and working with local government to enforce those standards.**
- **Supporting renewable energy by providing market support to existing, new, and emerging renewable technologies; providing incentives for small wind and fuel cell electricity systems; and providing incentives for solar electricity systems in new home construction.**
- **Implementing the state's Alternative and Renewable Fuel and Vehicle Technology Program.**
- **Planning for and directing state response to energy emergencies.**
- **Supporting public interest energy research that advances energy science and technology through research, development, and demonstration programs.**

Energy Assurance Through the Smart Grid

California Smart Grid Policies:

- Assembly Bill (AB) 32--*Global Warming Solutions Act*
- AB-118--*Alternative and Renewable Fuel and Vehicle Technology Program*
- Senate Bill 17--*Smart Grid Systems*
- *33% Renewable Portfolio Standard*
- *Pending Legislation—AB 2514--Energy Storage*

Energy Assurance Through the Smart Grid

California Senate Bill 17 Smart Grid Deployment Plans will Include:

- Smart Grid Vision Statement
- Deployment Baseline
- Smart Grid Strategy
- Grid Security and Cyber Security Strategy
- Smart Grid Roadmap
- Cost Estimates
- Benefits Estimates
- Metrics

Public Interest Energy Research (PIER) Program

- IOU Ratepayer-funded program launched in 1997 by AB1890
- Addresses electricity, natural gas, and transportation sectors
- Over $80 M annual budget; over $300M in active projects
- A leader in no/low-carbon science and technology programs
- Strong emphasis on partnerships

Energy Commission PIER Smart Grid Research Ongoing at all Levels

Transmission

- Phasor Measurement
- Advanced displays
- Advanced comm & controls
- MRTU interface
- Energy Storage
- Renewables

Distribution

- Distribution Automation
- AMI
- Advanced C&C
- MRTU
- Energy Storage
- Renewables

Integration

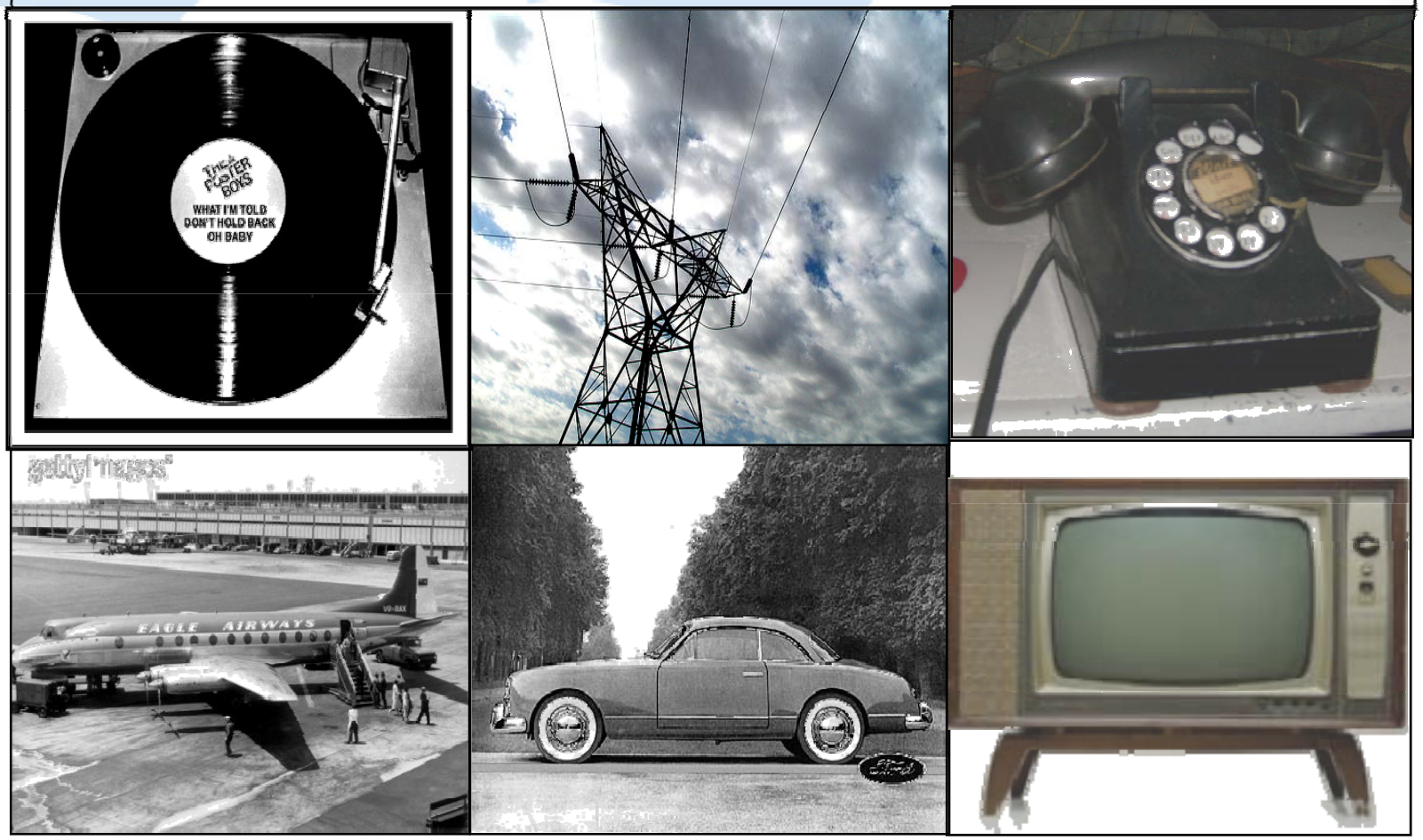
- Renewables
- Standards
- Protocols
- Reference designs
- Micro Grids
- Automation
- Energy Storage

Consumer

- Automating Demand Response
- AMI
- Dynamic Rates
- Home Area Networks
- Plug in Hybrids
- Renewables
- Energy Storage

BUILDING THE CALIFORNIA SMART GRID

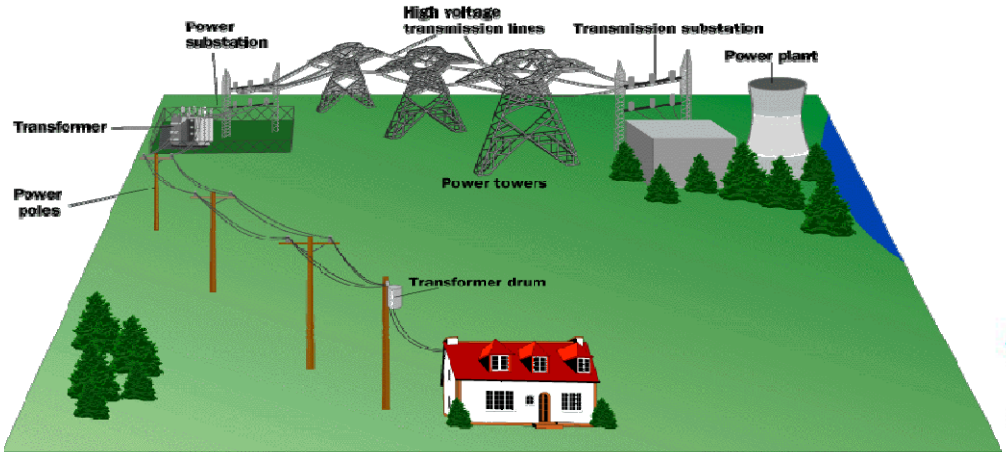
1950

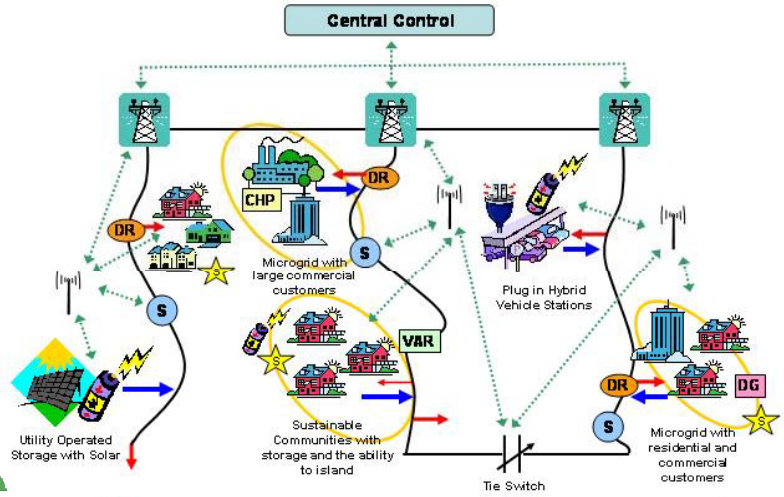


BUILDING THE CALIFORNIA SMART GRID

2010

Smart Grid Integration





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Energy Storage Technologies Applying Smart Grid Technologies

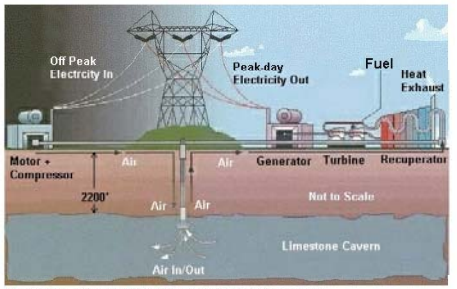
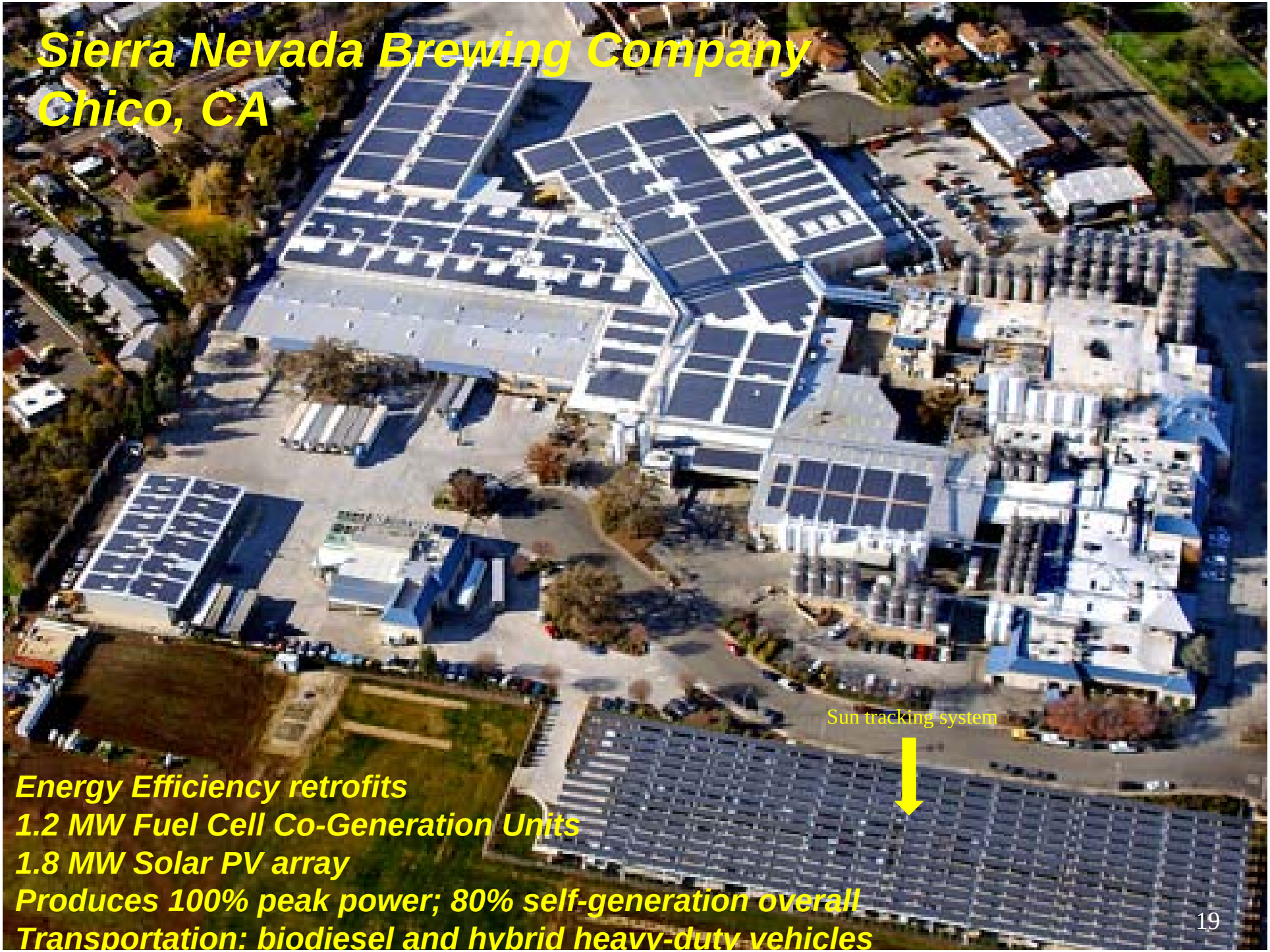


Photo Courtesy of CAES Development Company

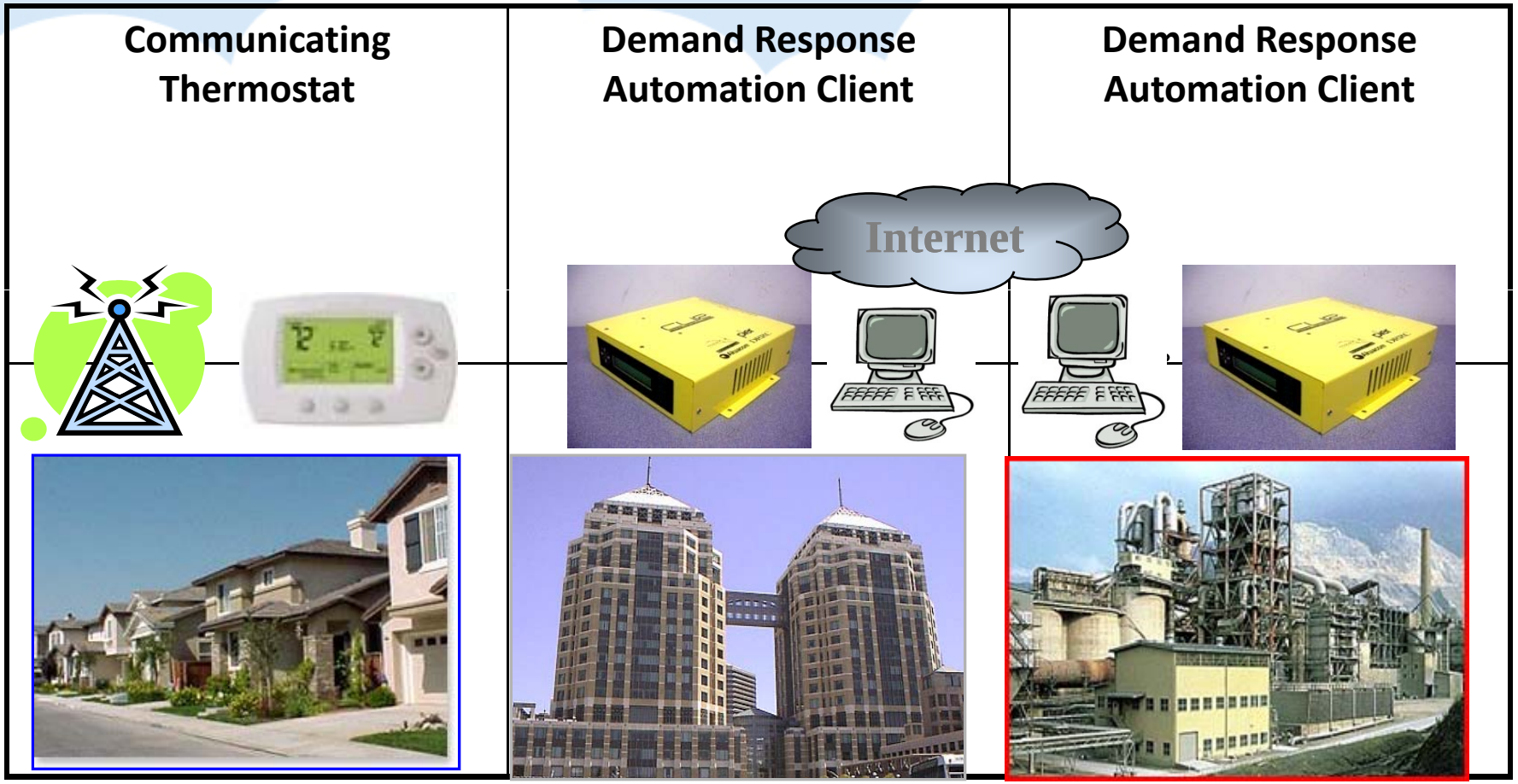
Photo Courtesy of Saft America



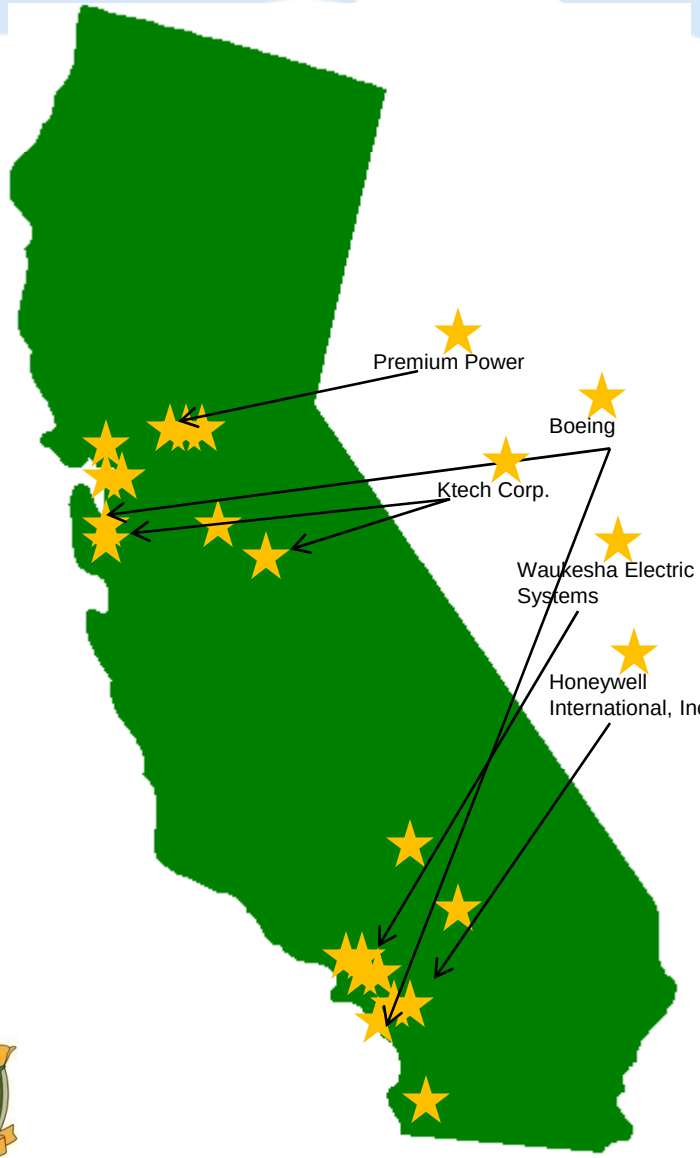
Sierra Nevada Brewing Company
Chico, CA

Energy Efficiency retrofits
1.2 MW Fuel Cell Co-Generation Units
1.8 MW Solar PV array
Produces 100% peak power; 80% self-generation overall
Transportation: biodiesel and hybrid heavy-duty vehicles

Demand Response Automation by Sector



ARRA Smart Grid in California



Total Project Value to CA - $1.3 Billion

- City of Glendale Water & Power
- Modesto Irrigation District
- Burbank Water & Power
- City of Anaheim
- Electric Power Group (WECC sub-contractor)
- Pacific Gas & Electric (WECC sub-contractor)
- Sacramento Municipal Utility District
- San Diego Gas & Electric
- Honeywell International, Inc. (Headquarters in MA, work being done in Southern CA)
- Los Angeles Department of Water & Power
- Southern California Edison
- Boeing (Headquarters in MO, work being done in Sunnyvale and Huntington Beach, CA)
- Waukesha Electric Systems (Headquarters in WI, work being done in Irvine, CA)
- Primus Power
- SEEO Inc.
- Southern California Edison
- Pacific Gas & Electric
- Amber Kinetics
- Ktech Corp. (Headquarters in NM, work being done in Sunnyvale and Snelling, CA)
- Sacramento Municipal Utility District (sub-contractor to Premium Power, Headquarters in MA)

California Smart Grid Center

Smart Grid Demonstrations **Technology Assessment** **Knowledge Transfer**

- Design and test Home Area Networks (HANs) and sensor networks
- Establish a Smart Grid Home laboratory to test smart new and emerging energy devices
- Develop ways to enable consumers to control their energy use
- Ensure a secure CA Smart Grid
- Research open and compatible control protocols
- Integrate Center activities into preparing the workforce
- Disseminate Center information to all stakeholders and interested parties

SACRAMENTO STATE
California Smart Grid Center

Director: Dr Emir Macari, Dean of Engineering

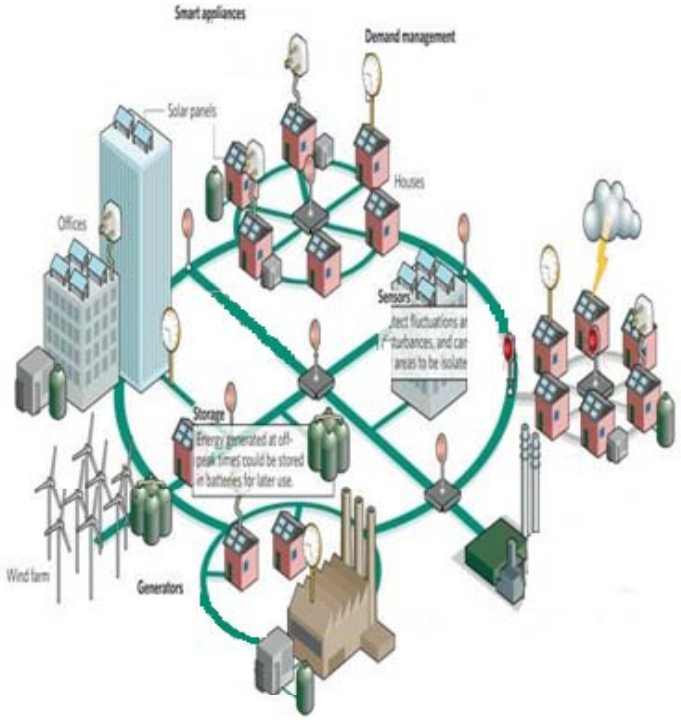
SDG&E MICROGRID PROJECT

What is it?

- Smart Grid Implementation & Integration (Borrego Springs, CA)

What are we doing?

- Integration PV/Wind/Storage
- Improving power reliability and quality
- Enhance management of intermittent renewable resources
- Islanding Effect
- Identify and evaluate technical and operational issues with operating a Smart Grid



PIER $2.8M + DOE $12.6M = Total Project $15.4M

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Smart Grid Initiative at Beale AFB

Beale Air Force Base – Air Combat Command

The 9th Reconnaissance Wing is responsible for providing national and theater command authorities with timely, reliable, high-quality, high-altitude reconnaissance products. To accomplish this mission, the wing is equipped with the nation's fleet of U-2 and RQ-4 Global Hawk reconnaissance aircraft and associated support equipment.

The wing maintains a high state of readiness in its combat support and combat service support forces for potential deployment in response to theater contingencies. The 9th Reconnaissance Wing is composed of more than 3,000 personnel in four groups at Beale and multiple overseas operating locations.

Smart Grid Initiative at Beale AFB

Air Force Bases Areas Reviewed for Opportunity:

- Integrated Energy-Environmental-Asset-Cost Management, Process Efficiencies & Technologies
- Lighting & Commercial Buildings-Related Technologies
- Residential Energy Efficiency
- Power Engineering & Distribution
- Cyber Security
- Demand Response & Demand Response Automation
- Renewable Energy & Bioenergy
- Energy Storage
- Western Area Power Administration (WAPA)
- Stimulus Funding Team

Smart Grid Initiative at Beale AFB

Air Force Bases Areas Reviewed for Opportunity:

Proposed Solid State Lighting
Residential Test Bed at Beale AFB
Beale AFB Transferability to all USAF Bases

CLTC California Lighting Technology Center
University of California ciee
PIER Public Interest Energy Research "Research Powers the Future"

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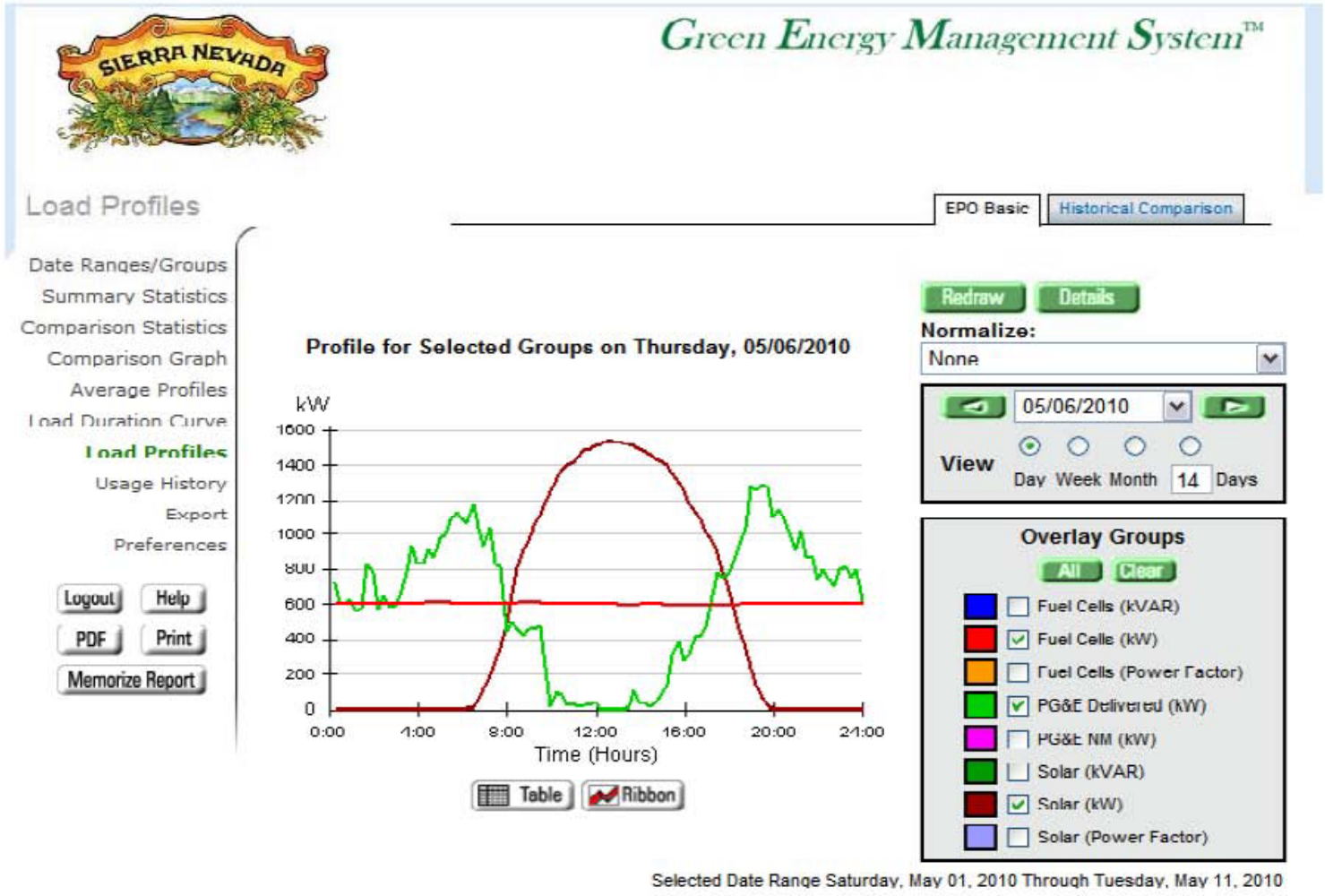
Smart Grid Initiative at Beale AFB



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Smart Grid Initiative at Beale AFB

Next Steps:

- Energy efficiency demonstration in the Contrails Dining Facility
  - Indoor and outside lighting improvements
  - HVAC upgrades and efficiency improvements
  - Kitchen cooking process equipment upgrade/EE improvements
- Monitor energy use before and after installation of equipment
- Develop business cases for wider deployment

Next Steps with California Military Facilities:

- Working with San Diego Navy and Marine facilities to repeat same process
  - Complete joint facility energy audits, surveys and assessments
  - Target energy efficiency, renewables, smart grid, energy management, EV, etc.
  - Consider for new clean energy technologies demonstrations

Energy Assurance Through the Smart Grid

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